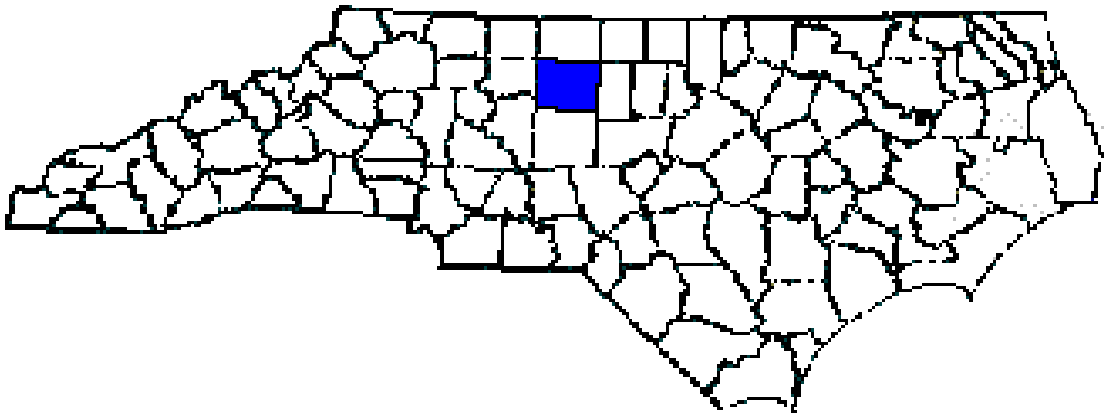
ANNUAL REPORT FOR 2011



Mile Branch
Guilford County
TIP No. R-0609IA

Prepared By:
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North Carolina Department of Transportation
November 2011

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SUMMARY

The following report summarizes the stream monitoring activities that have occurred during 2011 at the Mile Branch Mitigation Site in Guilford County. The site was constructed during 2008 by the North Carolina Department of Transportation (NCDOT). This report provides the monitoring results for the third formal year of monitoring (Year 2011). The Year 2011 monitoring period is the third of five scheduled years for monitoring on Mile Branch (See Success Criteria Section 2.1).

Based on the overall conclusions of monitoring along Mile Branch, the site has met the required monitoring protocols for the third formal year of monitoring. Based on the monitoring data, the channel is stable throughout the stream at this time. A bankfull event has occurred since the last monitoring evaluation. NCDOT replanted the buffer in January 2010 and replanted the streambank and buffer in March 2011 due to low tree survival.

On April 30, 2010, NCDOT repaired an area of the stream at Sta. 11+64 due to a wash out behind the cross vane arm. NCDOT repaired this area by placing boulders behind the right arm of the vane and installed a sill at the end of the arm. Also the cross vane at Sta. 11+42 had a boulder placed behind the left arm of the vane where washing had occurred. N.C. Division of Water Quality and U.S. Army Corps of Engineers personnel requested that this information be included in the monitoring report in lieu of completing a permit modification.

In late March 2011, NCDOT repaired the scour on the right bank from approximately 11+70 to 11+83 by installing boulder toe protection. All disturbed areas were seeded and matted. Live stakes and bare root seedlings were planted on March 29, 2011.

NCDOT will continue stream monitoring at the Mile Branch Mitigation Site in 2012.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during 2011 at the Mile Branch Mitigation Site. The site is located adjacent to the US 311 southbound lanes just east of SR 1158 Jackson Lake Road (Figure 1). The Mile Branch Mitigation Site was constructed to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) number R-0609IA in Guilford County.

The mitigation project covers approximately 659 linear feet of stream relocation. Construction was completed in August 2008 by the North Carolina Department of Transportation (NCDOT). Stream restoration involved the installation of rock cross vanes, rock sills, construction of a new stream channel and construction of the floodplain to allow for overbank flooding. It also included the installation of coir fiber matting and live stakes along the streambank and bareroot seedlings in the buffer area.

1.2 Purpose

In order for a mitigation site to be considered successful, the site must meet the success criteria. This report details the monitoring in 2011 at the Mile Branch Mitigation Site. Hydrologic monitoring was not required for the site.

1.3 Project History

August 2008	Construction Completed
January 2009	Planted Live Stakes and Bareroot Seedlings
September 2009	Stream Channel Monitoring (1 yr.)
January 2010	Replanted Buffer
April 2010	Streambank Repairs
October 2010	Stream Channel Monitoring (2 yr.)
March 2011	Streambank Repairs
March 2011	Replanted Streambank and Buffer
October 2011	Stream Channel Monitoring (3 yr.)

1.4 Debit Ledger

The entire Mile Branch stream mitigation site was used for the R-0609IA project to compensate for unavoidable stream impacts.

Figure 1. Vicinity Map

2.0 STREAM ASSESSMENT

2.1 Success Criteria

In accordance with the approved mitigation plan, NCDOT will evaluate the success of the stream relocation project based on guidance provided by the Stream Mitigation Guidelines disseminated by the United States Army Corps of Engineers-Wilmington District. The survey of channel dimension will consist of permanent cross sections placed at approximately four cross sections (two riffles and two pools). Annual photographs showing both banks and upstream and downstream views will be taken from permanent, mapped photo points. The survey of the longitudinal profile will represent distinct areas of the stream and will cover a cumulative total of 632 linear feet of channel. The entire restored length of stream will be investigated for channel stability and in-stream structure functionality. Any evidence of channel instability will be identified, mapped and photographed.

Vegetation Success

The success of vegetation plantings will be measured through stem counts. Permanent quadrants will be used to sample the riparian buffer. Survival of the live stakes will be determined by visual observation throughout the 5 year monitoring period.

Bareroot vegetation will be evaluated using 2 staked survival plots. Plots will be 50 ft. by 50 ft. and all flagged stems will be counted in those plots. Success will be defined as 320 stems per acre after 5 years. All vegetation monitoring will be conducted during the growing season.

2.2 Stream Description

2.2.1 Post-Construction Conditions

The mitigation project covers approximately 659 linear feet of stream relocation. Construction was completed in August 2008 by the North Carolina Department of Transportation (NCDOT). Stream restoration involved the installation of rock cross vanes, rock sills, construction of a new stream channel and construction of the floodplain to allow for overbank flooding. It also included the installation of coir fiber matting and live stakes along the streambank and bareroot seedlings in the buffer area.

2.2.2 Monitoring Conditions

The objective of the Mile Branch Mitigation Site relocation was to build a C4 stream type as identified in the Rosgen's Applied River Morphology. A total of four cross sections (two in a riffle, two in a pool) were surveyed. For this report, only cross sections containing riffles were used in the comparison of channel morphology in Table 1.

Table 1. Abbreviated Morphological Summary (Mile Branch Cross Sections #1 and #3)				
Variable	**Proposed**	**Cross Section #1 (Riffle)**	**Cross Section #3 (Riffle)**	**Min. - Max Values (Riffle Sections Only)**
		2011	**2011**	**2011**
Drainage Area (sq. mi)	**2.24**	2.24	2.24	2.24
Bankfull Width (ft)	**21.2**	27.4	19.93	19.93 – 27.4
Bankfull Mean Depth (ft)	**1.77**	0.99	1.48	0.99 – 1.48
Width/Depth Ratio	**12**	27.68	13.47	13.47 – 27.68
Bankfull Cross Sectional Area (ft^2)	**37.1**	27.14	29.6	27.14 – 29.6
Maximum Bankfull Depth (ft)	**2.62**	3.09	2.75	2.75 – 3.09
Flood prone Area (ft)	**147.6**	51	49.9	49.9 - 51
Entrenchment Ratio	**6.98**	1.86	2.5	1.86 – 2.5

*Drainage Area, Floodprone Width, and Slope are averaged values only.
*Riffle values are used for classification purposes.

2.3 Results of the Stream Assessment

2.3.1 Site Data

The assessment included the survey of four cross sections and the longitudinal profile of Mile Branch established by the NCDOT after construction. The length of the profile along Mile Branch was approximately 632 linear feet. Four cross sections were established during the 2009 monitoring year. Cross section locations were subsequently based on the stationing of the longitudinal profile and are presented below. The location of the cross sections and longitudinal profile are shown in Appendix A.

- Cross Section #1. Mile Branch, Station 83+00 linear feet, midpoint of riffle
- Cross Section #2. Mile Branch, Station 340+00 linear feet, midpoint of pool
- Cross Section #3. Mile Branch, Station 412+00 linear feet, midpoint of riffle
- Cross Section #4. Mile Branch, Station 520+00 linear feet, midpoint of pool

Based on comparisons of the monitoring data, all four cross sections appear stable with little or no active bank erosion. The floodplain on the right bank at Cross Section #4 had to be repaired after the as-built was completed. The right endpin at this cross section had to be reset due again to the latest streambank repairs. The graph of Cross Section #4 shows this layout. Graphs of the cross sections are presented in Appendix A. Future survey data will vary depending on actual location of rod placement and alignment; however this information should remain similar in appearance. The longitudinal profile shows that the channel is stable for the 2011 monitoring evaluation.

2.4 Results of Stream and Buffer Vegetation

2.4.1 Description of Species

The following live stake species were planted on the streambank:

Salix nigra, Black Willow

Cornus amomum, Silky Dogwood

The following tree species were planted in the buffer area:

Liriodendron tulipifera, Tulip Poplar

Platanus occidentalis, American Sycamore

Fraxinus pennsylvanica, Green Ash

Quercus phellos, Willow Oak

Nyssa sylvatica, Blackgum

Quercus lyrata, Overcup Oak

Betula nigra, River Birch

2.4.2 Results of Vegetation Monitoring

Buffer Vegetation: Two 50 ft. x 50 ft. vegetation plots were set to determine the trees per acre in the buffer area.

Plot #	Tulip Poplar	American Sycamore	Green Ash	Willow Oak	Overcup Oak	River Birch	Blackgum	Total (Year 3)	Total (at planting)	Density (Trees/Acre)
1	3	7	15	2			1	28	45	423
2	7	12	9	3	14	5	1	51	55	631
Average Density (Trees/Acre)										527

Site Notes: The black willow and silky dogwood live stakes were surviving along the streambank. Other vegetation noted included lespedeza, *Juncus* sp., fennel, woolgrass, alder, goldenrod, sweetgum, mimosa, sedge, and various grasses.

2.4.3 Conclusions

There were two vegetation monitoring plots established throughout the buffer area. The 2011 vegetation monitoring of the site revealed an average tree density of 527 trees per acre. This average is above the minimum success criteria of 320 trees per acre after the third year of monitoring. NCDOT replanted the buffer in January 2010 but the streambank and buffer area continued to lack planted vegetation for the second year of monitoring. NCDOT replanted the stream bank and buffer areas in March 2011 to increase plant survivability on site. Poor soil conditions and competition from lespedeza have been factors in the low tree survival. NCDOT will continue to monitor the vegetation at the Mile Branch Mitigation Site.

3.0 OVERALL CONCLUSIONS/RECOMMENDATIONS

The Mile Branch Mitigation Site has met the required monitoring protocols for the third formal year of monitoring. The channel and structures throughout the stream are stable at this time. NCDOT replanted the streambank and buffer in March 2011.

On April 30, 2010 NCDOT repaired an area of the stream at Sta. 11+64 due to a wash out behind the cross vane arm. NCDOT repaired this area by placing boulders behind the right hand arm and installed a sill at the end of the arm. Also the cross vane at Sta. 11+42 had a boulder placed behind the left hand arm where washing had occurred. N.C. Division of Water Quality and U.S. Army Corps of Engineers personnel requested that this information be included in the monitoring report in lieu of completing a permit mod.

In late March 2011, NCDOT repaired the scour on the right bank from approximately 11+70 to 11+83 by installing boulder toe protection. All disturbed areas were seeded and matted. Live stakes and bare root seedlings were planted on March 29, 2011.

NCDOT will continue stream monitoring at the Mile Branch Mitigation Site for 2012.

4.0 REFERENCES

Stream Mitigation Plan for Mile Branch (Permit Site 6); Guilford County, NC, September 11, 2006.

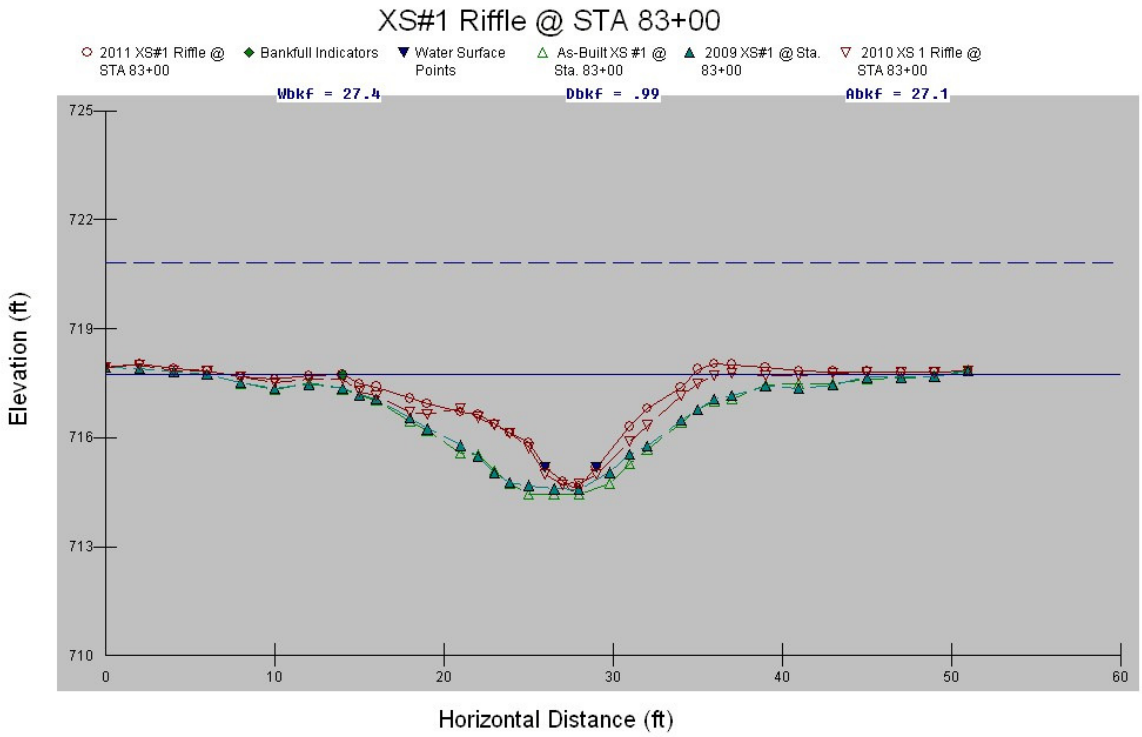
As-Built Report for Stream Restoration on R-609IA Permit Site 6, Guilford County, NC, March 20, 2009.

Rosgen, D.L, 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado.

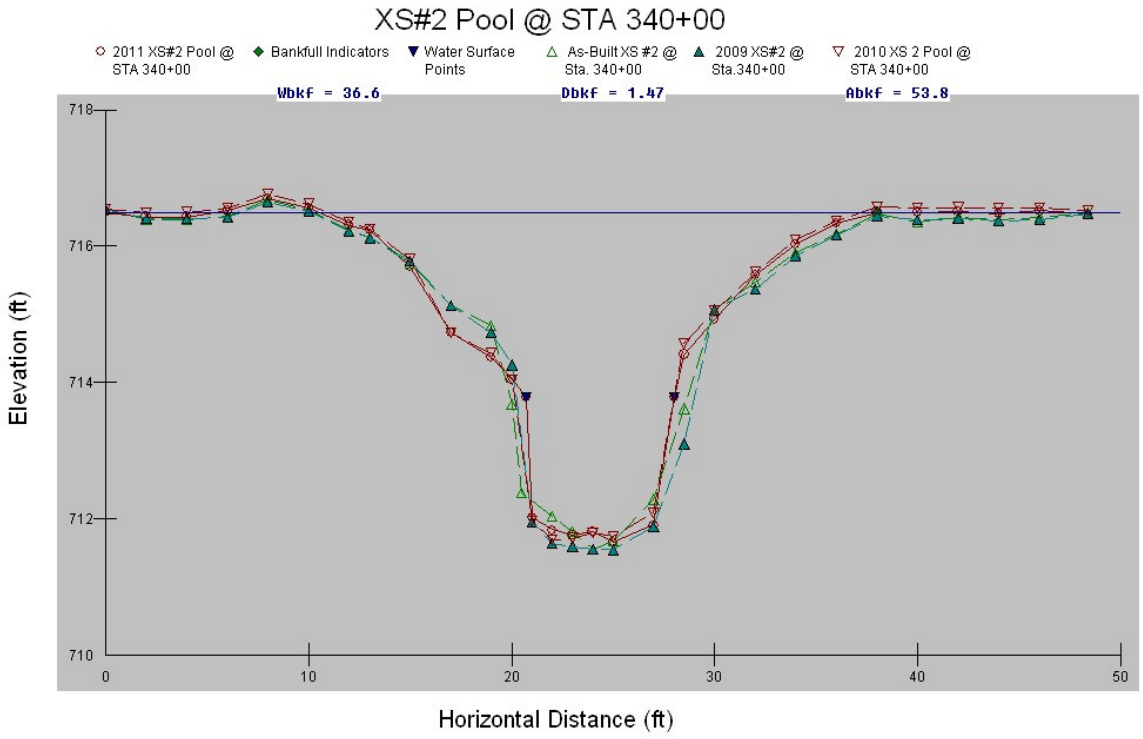
US Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines. Prepared with cooperation from the US Environmental Protection Agency, NC Wildlife Resources Commission, and the NC Division of Water Quality.

APPENDIX A

CROSS SECTION COMPARISONS
&
LONGTITUDINAL PROFILE

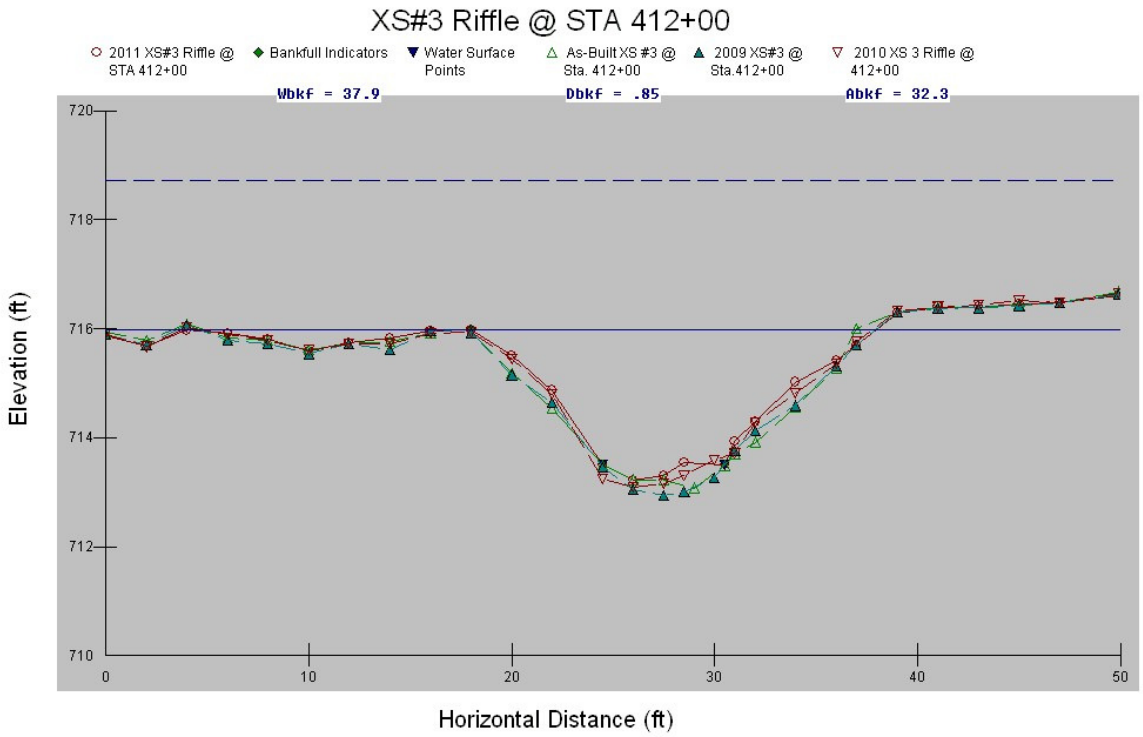


Cross-Section #1 (Riffle) Abbreviated Morphological Summary					
	2009	2010	2011	2012	2013
Bankfull Width (ft)	26.3	26.9	27.4		
Bankfull Mean Depth (ft)	1.4	1.06	0.99		
Width/Depth Ratio	18.8	25.38	27.68		
Bankfull Cross Sectional Area (ft^2)	36.9	28.64	27.14		
Maximum Bankfull Depth (ft)	2.86	2.91	3.09		
Width of the Floodprone Area (ft)	51	51	51		
Entrenchment Ratio	1.94	1.9	1.86		

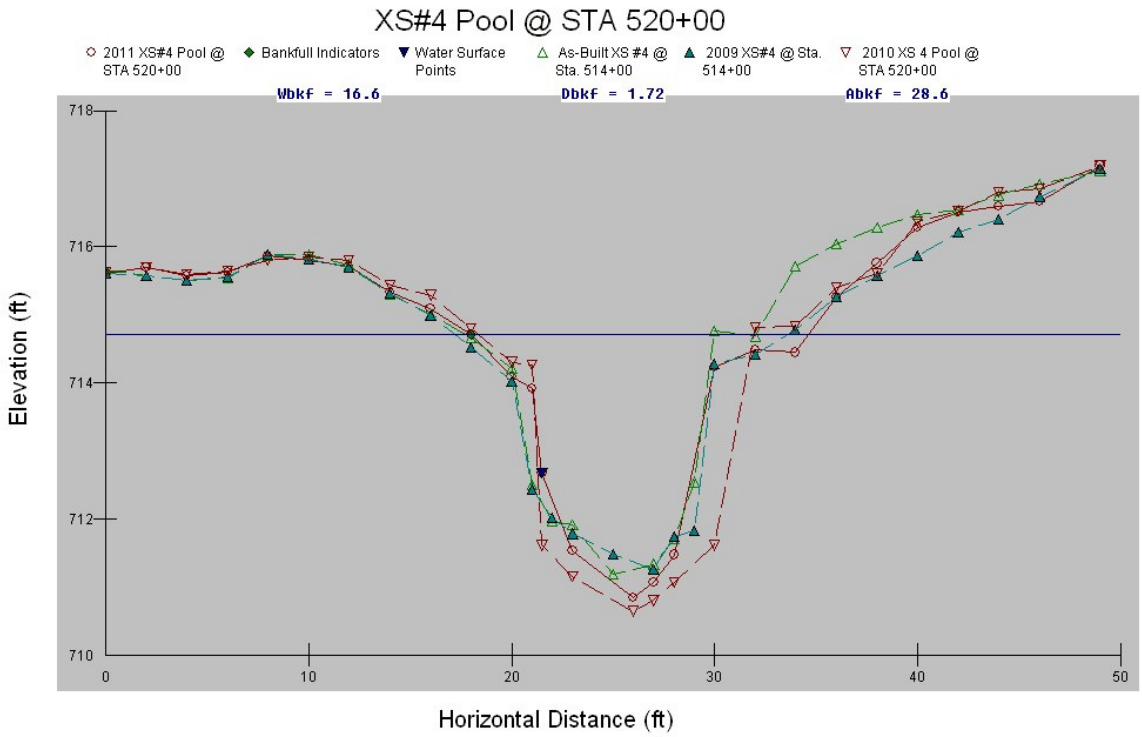


Cross-Section #2 (Pool) Abbreviated Morphological Summary*					
	2009	2010	2011	2012	2013
Bankfull Cross Sectional Area (ft^2)	55	55.65	53.54		
Maximum Bankfull Depth (ft)	4.89	4.89	4.84		
Bankfull Mean Depth (ft)	2	1.26	1.95		
Bankfull Width (ft)	27.52	27.69	27.52		

* According to the Rosgen Classification of Natural Rivers floodprone width, entrenchement ratio, and width depth ratio are not measured in pool, glide, or run features.



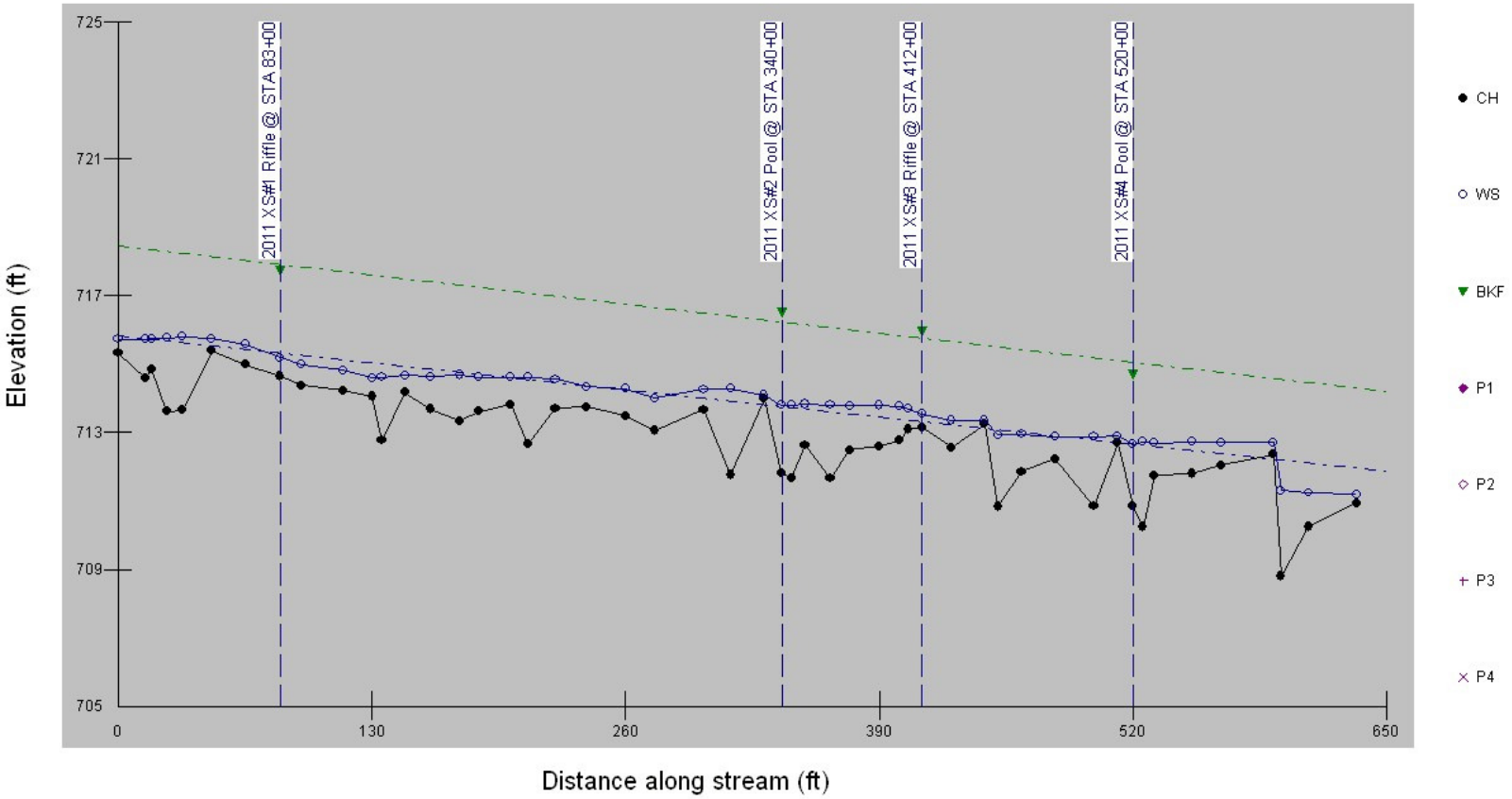
Cross-Section #3 (Riffle) Abbreviated Morphological Summary					
	2009	2010	2011	2012	2013
Bankfull Width (ft)	19.75	19.61	19.93		
Bankfull Mean Depth (ft)	1.68	1.57	1.48		
Width/Depth Ratio	11.76	12.49	13.47		
Bankfull Cross Sectional Area (ft^2)	33.15	30.76	29.6		
Maximum Bankfull Depth (ft)	3	2.84	2.75		
Width of the Floodprone Area (ft)	49.9	49.9	49.9		
Entrenchment Ratio	2.53	2.54	2.5		



Cross-Section #4 (Pool) Abbreviated Morphological Summary*					
	2009	2010	2011	2012	2013
Bankfull Cross Sectional Area (ft^2)	23.18	36.71	28.62		
Maximum Bankfull Depth (ft)	3.02	4.15	3.86		
Bankfull Mean Depth (ft)	2.11	2.62	1.72		
Bankfull Width (ft)	11	14	16.64		

* According to the Rosgen Classification of Natural Rivers floodprone width, entrenchment ratio, and width depth ratio are not measured in pool, glide, or run features.

Mile Branch Longitudinal Profile



APPENDIX B

SITE PHOTOGRAPHS, CROSS SECTION AND

PHOTO POINT LOCATIONS

Mile Branch

Photo Point #1 (Upstream)

Photo Point #1 (Downstream)

Photo Point #2 (Upstream on Trib. 1)

Photo Point #2 (Downstream on Trib. 1)

Photo Point #3 (Upstream)

Photo Point #3 (Downstream)

October 2011

Mile Branch

Photo Point #4 (Upstream)

Photo Point #4 (Downstream)

Photo Point #5 (Upstream on Main Channel)

Photo Point #5 (Upstream on Trib. 2)

Photo Point #5 (Downstream on Main Channel)
October 2011

Mile Branch

Photo Point #6 (Upstream)

Photo Point #6 (Downstream)

Vegetation Plot #1 taken from Photo Point #1

Vegetation Plot #2 taken from Photo Point #3

Overview Photo

October 2011

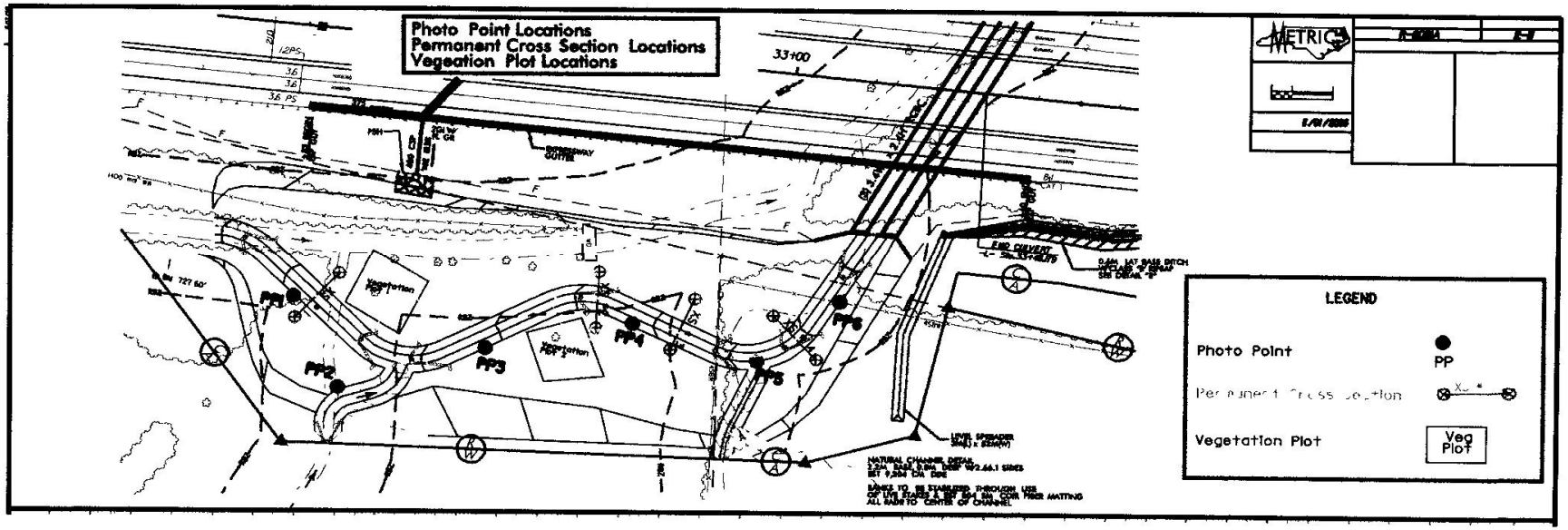


Photo Point Locations
Permanent Cross Section Locations
Vegeation Plot Locations
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PP1
PP2
PP3
PP4
PP5
PP6
Vegetation
Vegetation
LEGEND
Photo Point
PP
Permanent Cross Section
Vegetation Plot
Veg Plot